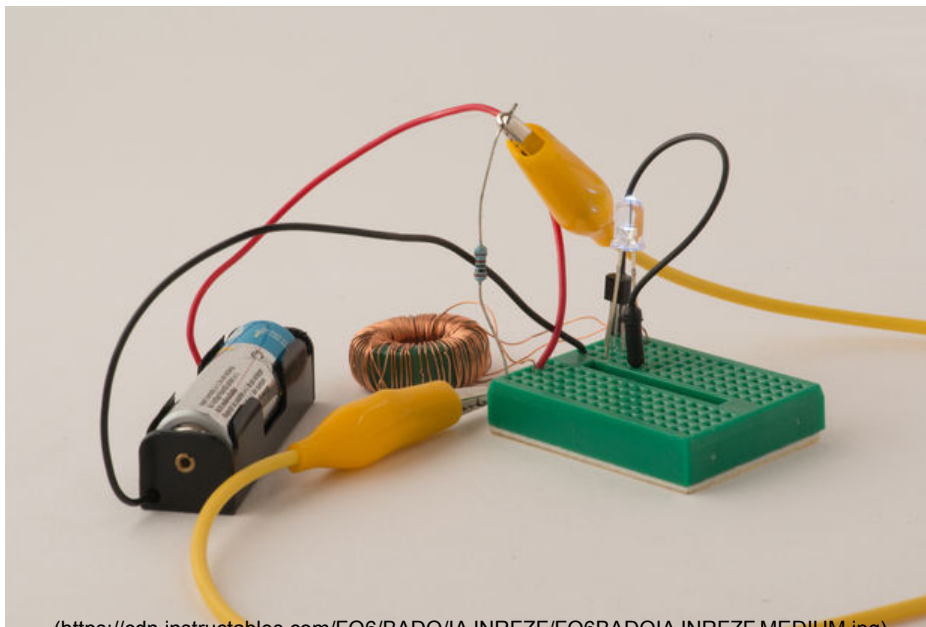


Secrets from the Sound Suite with St. Vincent

W Hotels



This is an introduction into the operation of a Joule Thief and a brief look at it's history. In November 1999 a simple circuit was published by Z. Kaparnik of a transformer-feedback single-transistor voltage converter in Everyday Practical Electronics magazine. The Joule Thief circuit is based on the blocking oscillator which predates World War II.

The circuit starts when the transistor is off. Current flows through the left hand side of the transformer and through the 1k resistor, into the base of the transistor. The transistor turns on slightly and produces a current in the collector emitter circuit. This allows current to flow in the right hand winding of the transformer and produce magnetic flux. This flux cuts the turns of the left hand winding and produces a voltage that adds to the voltage produced by the battery.

This increases the current into the base of the transistor and the transistors turns on more. This continues and the transistor turns on more and more until it cannot turn on any harder. At this point the magnetic flux in the right hand winding is a maximum but is not expanding flux and thus the left hand winding does not produce any additional voltage. The current into the base of the transistor reduces and the transistor turns off slightly.

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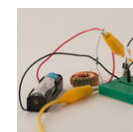
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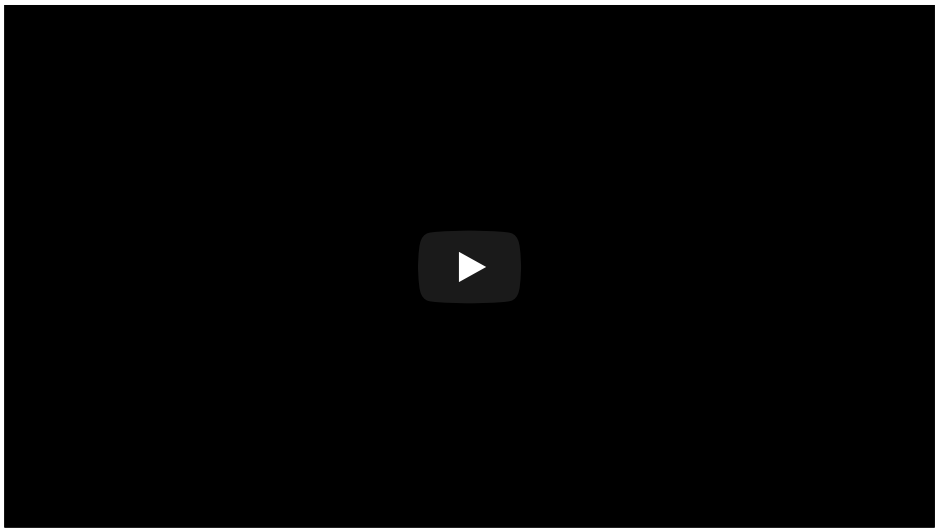


(/id/Joule-Thief-Explained/)

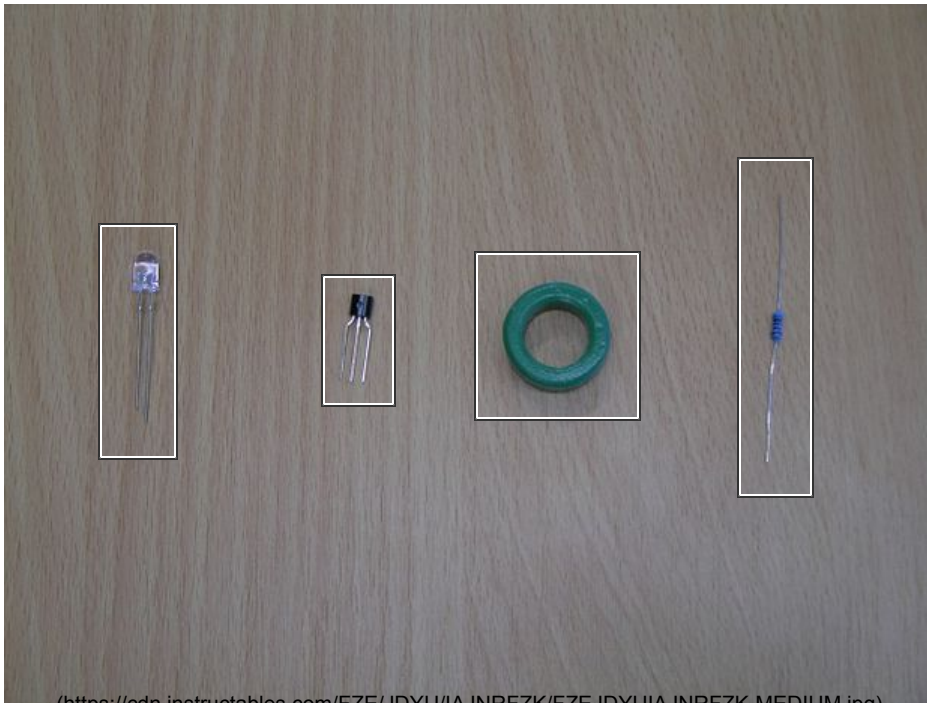
The current through the right hand side of the winding reduces and the magnetic energy in the core of the ferrite ring starts to collapse and produce a voltage (in both windings) of opposite polarity. In the left winding, it starts to turn the transistor off completely and in the right winding, it delivers this energy to the LED. Now here's the clever part. When the current is abruptly switched off, as is the case with this circuit, a voltage is produced in both windings that has opposite polarity to the original voltage and will be higher amplitude than the original voltage.

This voltage can be 10 or even 100 times higher than the original voltage and this is called the "Q" of the circuit. We are not creating something for nothing as the voltage will be higher but the current will be lower than the current drawn from the battery. The voltage produced by this circuit will be over 10v but a white LED has a characteristic voltage of about 3.2v to 3.6v and all the energy in the 10v spike, and the accompanying current, will be delivered to the LED to produce illumination. The LED starts to absorb energy at 3.2v and that's why the voltage across it never gets any higher than 3.6v.

Step 1: Quick Video



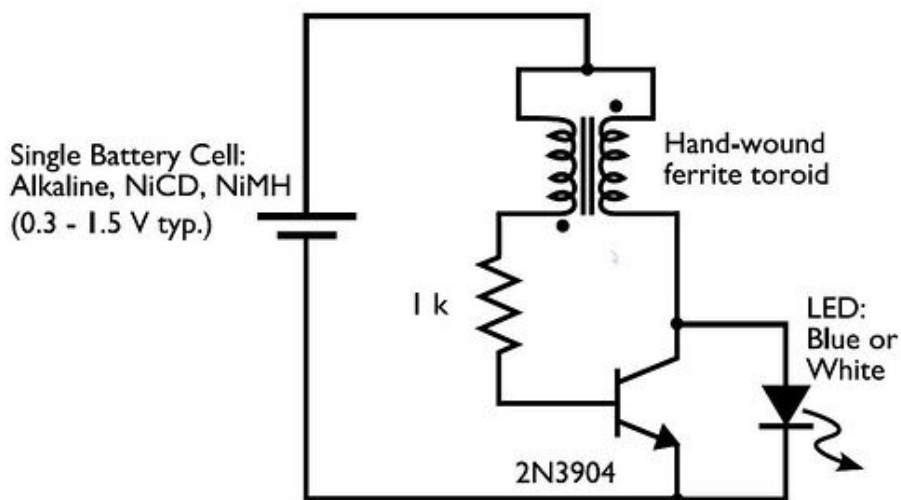
Step 2: Components



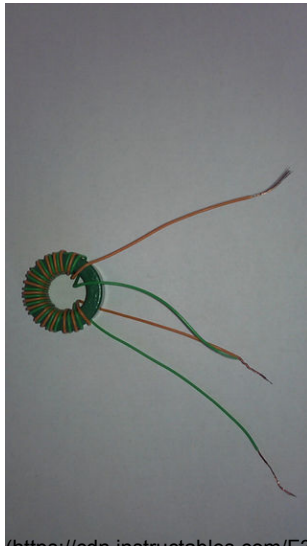
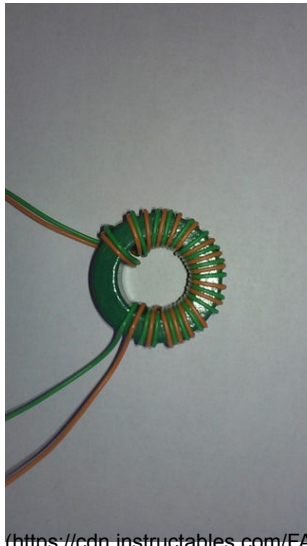
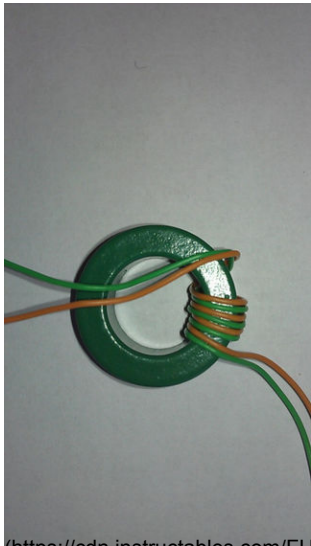
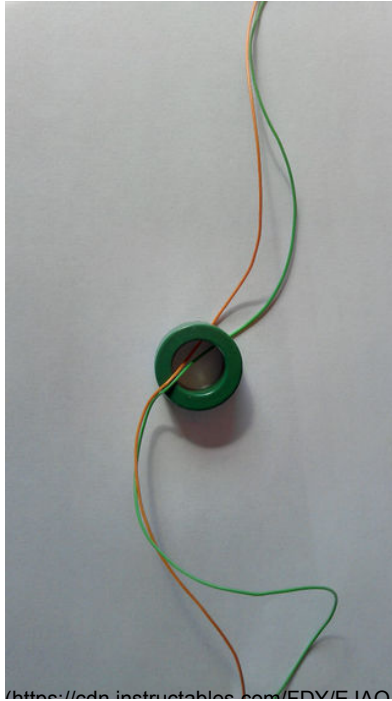
- 1) NPN Transistor
- 2) 3V Super Bright LED (any colour will be fine)
- 3) Wiring (x2 meters)
- 4) Breadboard (http://www.ebay.co.uk/itm/170-point-Solderless-mini-Breadboard-perfect-for-Arduino-proto-shields-/121599131538?pt=LH_DefaultDomain_3&var=&hash=item1c4fdf7f92)*
- 5) Ferrite Core
- 6) 1K Ohm Resistor

The breadboard is not really necessary though for beginners it could be ideal to help with further experiment too.

Step 3: Circuit Diagram



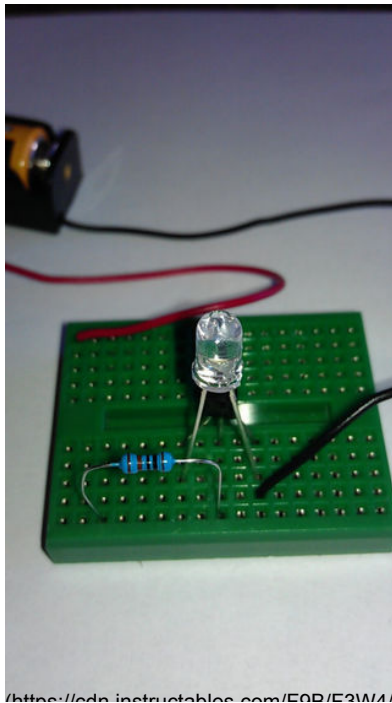
Step 4: Construction - Wiring the Toriod



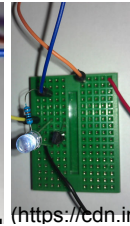
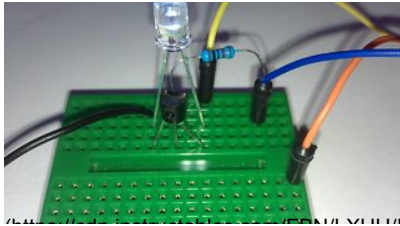
Wiring the toroid is the perhaps the most difficult part of constructing a Joule Thief. Essentially you are creating two windings around the toroid (called a bifilar winding). Take your time and don't rush especially if it's your first time winding a toroid :) It's easier if the wires are different colours too.

1. Take two strands of insulting wire and thread them through the toroid as seen in the first figure above: (Keep around 2cm of wire for the connections.)
2. Begin winding the wire strands around the toroid as seen in the next image. Please note how the wires are wound correctly:
3. Make 15-18 turns of the wire through the toroid as shown in the next image above.
4. Connect the two different coloured wire strands from either side of the toroid and connect them together. Your toroid should look similar to the last figure above.

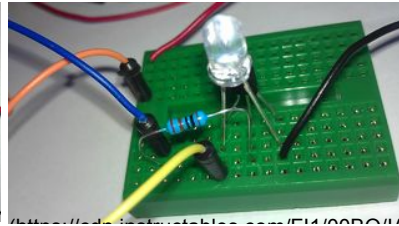
Step 5: Construction - Building the Circuit



(https://cdn.instructables.com/F0B/E2W4/)



(https://cdn.in



(https://cdn.instructables.com/F14/00DQ/)

If you are you using the breadboard please examine the images above on where to place the components. See the circuit diagram in Step 3 to familiarize yourself with the way the components are connected.#

1. Place the breadboard on a flat surface and gather the transistor, resistor and LED
2. Insert the transistor, LED and resistor into the breadboard sockets as shown above
3. Connect the toroid to the breadboard. The twisted wires go to the positive terminal of the battery
4. Connect the orange coloured wire to the resistor
5. Connect the green wire to the collector terminal of the transistor and the long lead of the LED (Anode)

Step 6: Conclusion - Working Joule Thief

15 Minute Joule Thief by playmonkey (/member/playmonkey/) in electronics (/technology/electronics/)



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⌵ (/id/Joule-Thief-Explained/)

6 Steps



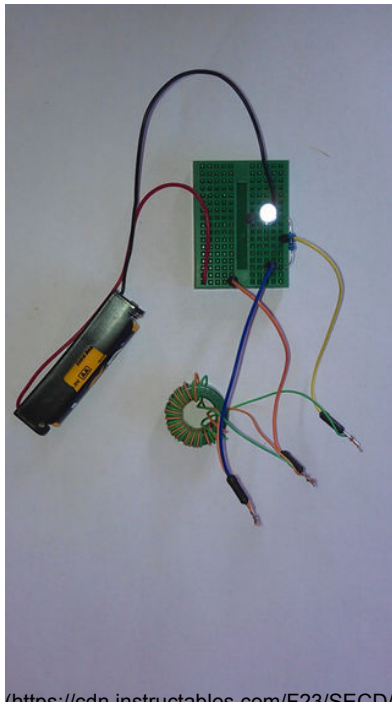
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<https://cdn.instructables.com/F23/S5ED/>



If you have connected the components as shown and wired the toroid correctly your joule thief LED should be shining brightly. Experiment with more turns on the toroid and/or use a larger ferrite toroid. Happy hacking!!



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**Your day with
ADHD
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ADHD = Attention Deficit
Hyperactivity Disorder

IMPORTANT SAFETY INFORMATION

Abuse and dependence. Mydayis, other amphetamine containing medicines, and methylphenidate have a high chance for abuse and can cause physical and psychological dependence.


Please see: [Medication Guide](#)


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be nice

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XxelectricmanX (/member/XxelectricmanX/)

2015-06-08

[Reply](#)

Dude, You have no idea how much I live joule thieves, awesome instructable! You should do more!!!!



playmonkey (/member/playmonkey/) ▶ XxelectricmanxX (/member/XxelectricmanxX/)

Thanks :D Joule Thief's are pretty amazing!! Have you
seen the famous Fuji Thief? https://www.youtube.com/watch?v=EcJG_6YF1X4

2015-06-09

Reply



blakehx (/member/blakehx/)

2015-08-20

Reply

Is it possible to have too many turns around the toroid? I probably have 25-30 turns of magnet wire around my toroid but can't get it to work with any voltage! Can't think what else to try! Any help greatly appreciated thanks!



JYon (/member/JYon/) ▶ blakehx (/member/blakehx/)

2017-05-01

Reply

There may be too much power being wasted, as magnet wire is made for creating a magnetic field, and a magnetic field would drain a bit of power. Try using a normal wire?



playmonkey (/member/playmonkey/) ▶ blakehx (/member/blakehx/)

2015-08-24

Reply

It should not make any difference really, power the JT using a new battery and see if it works? Otherwise I would re-check all the connections and especially the way the toroid is wired and connected. Hope that helps??



Emmanuel2015 (/member/Emmanuel2015/) made it! 

2016-07-16

Reply

Fun circuit, that little guy does the job ! I can hear a high pitched sound close to the coil, looks like about 10 kHz with the scope.

(<https://cdn.instructables.com/F7Z/TMKE/IQO23VYQ/F7ZTMKEIQO23VYQ.LARGE.jpg>)

playmonkey (/member/playmonkey/) ▶ Emmanuel2015 (/member/Emmanuel2015/)

Thanks for building the circuit!!! It's a bit annoying the
high pitched sound. Not sure why it does that?? Core harmonics?

2016-07-18

Reply

Emmanuel2015 (/member/Emmanuel2015/) ▶ playmonkey (/member/playmonkey/)

According to what I found on the web, the frequency is
inversely proportional to the inductance which itself is proportional to the square of the number of loops. So, if you want to stop hearing that sound, you might consider lowering the number of loops to have a frequency high enough to be outside of the hearing range (depends on your age).

2016-07-18

Reply

playmonkey (/member/playmonkey/) ▶ Emmanuel2015 (/member/Emmanuel2015/)

Thanks that's really interesting!! Potentially could be used as a low-cost device to test human hearing :) Time to do a bit more research!!

2016-07-18

Reply

Vehner (/member/_Vehner_/)

2015-08-02

Reply

I made my joule thief. I made it work with a simple dry run, but after that it stopped working? Anyone got any ideas?

playmonkey (/member/playmonkey/) ▶ _Vehner_ (/member/_Vehner_/)

Reply

How long did it work for? What voltage is the battery giving? Try another battery and see if it works?

2015-08-04

eyal_hadar (/member/eyal_hadar/) ▶ playmonkey (/member/playmonkey/)

Reply

Worked for five hours.
Although the batteries were not full, instead of 3 volts was 2.5
The light seems incredible that taken to increase the light is weak.
Increased exposure, otherwise the camera does not catch the frequency of the LED.

2015-10-05

eyal_hadar (/member/eyal_hadar/)

2015-06-11

Reply

j.t in work only 2 AA 600 led 10m long

(<https://cdn.instructables.com/FKY/B8EV/IAS213BK/FKYB8EVIAS213BK.LARGE.jpg>)

eyal_hadar (/member/eyal_hadar/) ▶ eyal_hadar (/member/eyal_hadar/)

Reply

im still checking it

2015-10-05

(<https://cdn.instructables.com/FQX/BSLI/IFDSTWPB/FQXBSLIIFDSTWPB.LARGE.jpg>)

playmonkey (/member/playmonkey/) ▶ eyal_hadar (/member/eyal_hadar/)

Reply

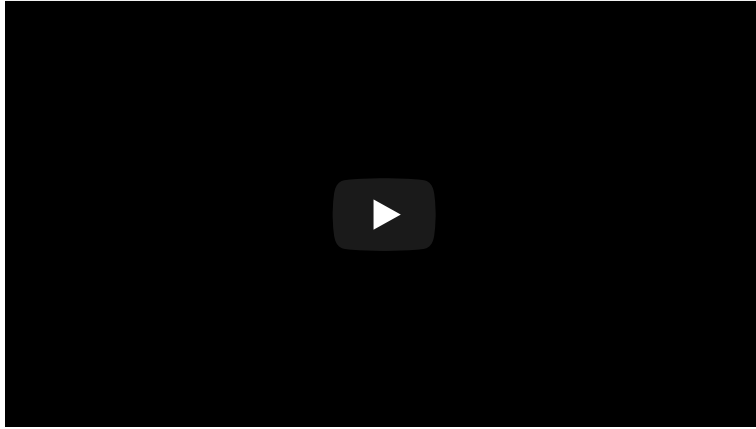
Amazing stuff!!

2015-06-13

eyal_hadar (/member/eyal_hadar/)

2015-06-11

Reply



Malkaris (/member/Malkaris/)

2015-06-09

Reply

Thank you very much, I've been looking for a well documented explanation of this device!

playmonkey (/member/playmonkey/) ▶ Malkaris (/member/Malkaris/)

Reply

Thank you, glad the instructable helped :)

2015-06-09

DharaniD (/member/DharaniD/) made it!

2015-06-09

Reply

dude awesome. we would. be a partner

(<https://cdn.instructables.com/FKO/KUHC/IAPAFYOE/FKOKUHCIAPAFYOE.LARGE.jpg>)

Ploopy (/member/Ploopy/)

2015-06-09

Reply

Cool!

playmonkey (/member/playmonkey/) ▶ Ploopy (/member/Ploopy/)

Reply

Thanks :)

2015-06-09

pucksurfer (/member/pucksurfer/)

2015-06-09

Reply

Is this how they make it so you can charge your phone with just 1 AA battery?

playmonkey (/member/playmonkey/) ▶ pucksurfer (/member/pucksurfer/)

Reply

2015-06-09

It's not really possible to charge it from a single AA 1.5v battery as most mobiles need around 500mA @ 5v. As the JT output voltage increase the current decreases so it may generate 5v there will not be enough current to charge the mobile. Hope that helps?

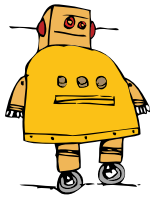
XxelectricmanxX (/member/XxelectricmanxX/)

2015-06-08

Reply

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